4.59.1 DUTIES OF THE PAVING INSPECTOR

The inspector must be thoroughly familiar with the specifications and see that they are complied with during asphalt paving operations. When inspecting paving operations the inspector should:

- Ensure that each load of mix is satisfactory, that data from the truck tickets are recorded accurately, and that the paver is operated properly.
- Ensure corrections are made before the mix cools if any deficiencies appear in the mat during placing.
- Pay attention to details such as proper thickness of the spread, proper crown, properly constructed and matched joints, correct surface texture and uniformity, and the rate of “tack” application.
- Monitor the temperature of the hot mix to ensure that proper mix temperature is maintained during the paving operation.
- Maintain a diary or a record for future reference and record anything unusual or events that may be useful at a later date.

The inspector must keep accurate records. In addition to the information included on haul tickets, there are other important items that must be recorded as part of the permanent records. Any unusual occurrences or changes in construction methods, equipment, appearance, or handling properties of the mix should be noted in the diary along with the station (location) on the roadway where the change was made. The daily diary is for the inspector's convenience during construction, but upon completion of construction it becomes a part of the permanent records of the project. In addition to the information shown above, the inspector should include summaries of test reports of density of pavement samples for each type of mixture used. The inspector should also note any delays and their causes, as well as list all visitors to the project.

The inspector must be able to identify deficiencies in the finished pavement and understand possible causes of those deficiencies. Keep in mind that a given deficiency may have several possible causes. In many cases, sampling and testing is the only reliable means for analyzing a pavement problem. Refer to Table 1 and Table 2 for troubleshooting guides to mat deficiencies, problems, and imperfections.

4.59.2 TEMPERATURE OF THE MIX

The mix temperature is usually checked in the truck; occasionally, it should be checked behind the paver. This is particularly important early in the day when both the surface on which the material is being placed and the air are cool. It must also be checked whenever the mix appears to be cold or when the breakdown roller is falling behind.

Mat temperature is taken by inserting the thermometer stem into the uncompacted mat to the mid-point of the mat’s thickness and compacting the mat against the stem by lightly tamping the mat surface with one foot.

4.59.3 TORN OR OPEN TEXTURE

The texture of the mat before compaction should appear uniformly dense, both transversely and longitudinally. If tearing or open texture appears only at the beginning of a day’s run, it is probably caused by the screed not being heated sufficiently. If a tear appears under screed extensions, the alignment of the extension and the tamping bars and vibrators need to be checked. Tearing and scuffing will also result from improper setting of a paver equipped with a tamping bar in the screed unit.

If there is an open or torn texture at the center of the mat behind the paver, additional lead crown may be needed in the front edge of the screed. This forces more mix into the central portion of the screed, closing the texture. If the tears occur on the outer edge, there may be too much crown in the leading edge, forcing too much material in the center and too little at the edges. Reducing the center crown slightly will distribute more material toward the edges and provide a more uniform mat.

Tearing often occurs in a mix that is too cold, or which appears open and coarse.

A mix containing excess moisture will not lie properly and will have the appearance of a cold mix or an over-asphalted mix. In addition to possibly tearing, the mix will bubble and blister.

4.59.4 SURFACE SMOOTHNESS

Pavement smoothness is adversely affected by a lack of uniformity in the paving operations, improper aggregate gradation, variations in paver speed, improper operation of trucks, and poor joint construction

practices.

Stopping the paver can cause roughness in the pavement. Every time the paver stops, there is a possibility of the screed leaving a mark on the surface of the mat. If the screed settles into the mix, it causes the automatic sensor to act as if the paver has traveled into a depression. As the paver starts off, the screed lays a thicker mat. This continues until the sensor recognizes the excessive thickness and decreases the slope of the screed. Then a dip is developed until the screed levels out, approximately 50 feet from where the paver stopped.

Rough pavements also result from changes in amounts of material introduced in front of the screed. If there is not enough material in front of the screed, the screed will drop. If there is too much material in front of the screed, it will rise. The ideal situation is to maintain a uniform amount of mix ahead of the screed at all times.

Excessively coarse aggregate may result in a harsh mix that creates a coarse texture and an uneven surface. Excessive fines may cause a low stability in the mix and permit ripples to form. Remediation will have to begin with revisions to the aggregate sizing and gradation.

		Cracking	Tearing	Wavy Mats	Segregation
Mix	Excess 75 μm material	×			
	Too hot or too cold	×			
	Too dry or too rich		×		
	Lack of fines		×		
	Too cold		×		
	Improper mat thickness vs. aggregate size ratio		×		
Plant	Mixing temperature fluctuations			×	
	Segregated aggregate stockpile				×
	Poor cold feed				×
	No. 1 hot bin segregation				×
	Insufficient dry mix time				×
Trucks	Truck brake set too hard			×	
	Improper loading of truck				×
Roller	Improper rolling			×	
	Over-rolling where base deflects	×			
	Turning too abruptly	×			
	Reversing too abruptly	×		×	
Finisher	Build-up in hopper sides				×
	Flushing of fines				×
	Screed over-control			×	
	Over-loading spreading screws			×	
	Screed rams holding			×	
	Condition of tamper or screed		×		
	Adjustment of tamper or screed		×		

Table 1: General Problems and Causes in Placing Asphaltic Pavements

Types of pavement imperfections that may be encountered in laying plant-mix paving mixtures.	Bleeding	Brown, dead appearance	Rich or fat spots	Poor surface texture	Rough uneven surface	Honeycomb or raveling	Uneven joints	Roller marks	Pushing or waves	Cracking (many fine cracks)	Cracking (large long cracks)	Rocks broken by roller	Tearing of surface during Laying	Surface slipping on base
Operating finishing machine too fast				×	×								×	
Excessive segregation in laying			×	×	×	×	×						×	
Labor careless or unskilled				×	×	×	×	×						
Excessive hand raking				×	×	×	×		×					
Excessive prime coat or tack coat	×		×											×
Excessive moisture in subsoil										×	×			×
Overweight rollers					×			×	×	×	×	×		×
Roller standing on hot pavement					×			×						
Rolling mixture when too cold				×	×	×	×	×						×
Rolling mixture when too hot				×	×		×	×	×	×		×		
Over-rolling				×						×	×	×		×
Inadequate rolling				×	×	×	×	×						×
Spreader in poor condition				×	×	×	×		×			×	×	
Poor spreader operation				×	×	×	×		×			×	×	
Mixture too cold				×	×	×	×	×				×	×	×
Mixture too hot or burned		×							×				×	
Excess moisture in mixture		×							×					×
Unsatisfactory batches in load	×		×	×	×	×			×					
Improperly proportioned mixture	×		×	×	×	×		×	×	×		×	×	×
Excess asphalt	×		×					×	×					×
Insufficient asphalt		×				×				×			×	
Excess fines in mixture				×				×	×	×				×
Mixture too coarse				×	×	×	×					×	×	
Improperly cured prime or tack coat					×				×					×
Insufficient or non-uniform tack coat					×				×					×

Table 2: Specific Problems and Causes in Placing Asphaltic Pavements

Part A PROBLEMS	CAUSES Fluctuating head of material	Feeder screws overloaded	Finisher speed too fast	Too much lead crown in screed	Too little lead crown in screws	Over-correcting thickness control screws	Excessive play in screed mechanical connection	Screed riving on lift cylinders	Screed plates worn out or warped	Screed plates not tight	Cold screed	Moldboard on strikeoff too low	Running hopper empty between loads	Feeder gates set incorrectly	Kicker screws worn out or mounted incorrectly	Incorrect nulling of screed	Screed starting blocks too short	Screed extensions installed incorrectly	Vibrators running too slow
Wavy surface - short waves (ripples)	✓	✓	✓				✓	✓		✓									
Wavy surface - long waves	✓	✓				✓	✓	✓					✓	✓					
Tearing of mat - full width			✓						✓		✓								
Tearing of mat - center streak					✓				✓		✓			✓	✓				
Tearing of mat - outside streaks				✓					✓		✓	✓		✓				✓	
Mat texture - non-uniform	✓	✓	✓					✓	✓	✓	✓		✓					✓	✓
Screed marks							✓												
Screed not responding to correction			✓				✓	✓		✓									
Auger shadows		✓																	
Poor pre-compaction			✓					✓											✓
Poor longitudinal joint	✓	✓				✓		✓											
Poor transverse joint		✓					✓	✓		✓						✓	✓		

1. Find problem above.
2. ✓'s indicate causes related to the paver.
3. X's indicate other problems to be investigated (continued on next page.)

NOTE:
Many times a problem can be caused by more than one item; therefore, it is important that each cause listed is eliminated to ensure solving the problem.

Table 2: Specific Problems and Causes in Placing Asphaltic Pavements (cont'd)

Part B	CAUSES																		
PROBLEM	Grade control mounted incorrectly	Grade control hunting (sensitivity too high)	Grade control wand bouncing on reference	Grade reference inadequate	Sitting long period between loads	Improper joint overlap	Improper mat thickness for max. agg. size	Trucks bumping finisher	Truck holding brakes	Improper base preparation	Improper rolling operation	Reversing or turning too fast of rollers	Parking roller on hot mat	Improper mix design (aggregate)	Improper mix design (asphalt)	Mix segregation	Moisture in mix	Variation of mix temperature	Cold mix temperature
Wavy surface-short waves (Ripples)	✓	✓	✓	✓						×	×			×	×	×		×	
Wavy surface-long waves	✓			✓	✓			×	×	×		×	×			×		×	
Tearing of mat-full width							×							×	×	×	×	×	×
Tearing of mat-center Streak																			×
Tearing of mat-outside streaks																			×
Mat texture-nonuniform					✓		×			×				×	×	×		×	×
Screed marks								×	×										
Screed not responding to correction	✓						×											×	×
Auger shadows														×	×	×			
Poor pre-compaction							×			×									×
Poor longitudinal joint	✓	✓	✓			✓					×								×
Poor transverse joint											×								×
Transverse cracking (checking)										×	×			×	×		×	×	
Mat shoving under roller										×	×	×		×	×		×	×	
Bleeding or fat spots in mat														×	×		×	×	
Roller marks										×	×	×	×					×	
Poor mix compaction										×	×	×	×	×	×		×	×	×

1. Find problem above.
2. ✓'s indicate causes related to the paver.
3. X's indicate other problems to be investigated.

NOTE:
Many times a problem can be caused by more than one item, therefore, it is important that each cause listed is eliminated to assure solving the problem.

Table 2: Specific Problems and Causes in Placing Asphaltic Pavements (cont'd)

4.59.5 PAVEMENT GEOMETRICS

Geometrics refer to the physical size and shape of the finished pavement. It includes longitudinal grade, cross

slope, alignment, crown, and thickness. Checking the geometrics involves first knowing the plan typical section, taking measurements, and comparing results against the plan. Measurements should be done as early as possible to catch errors in the paving operations, and then be repeated as needed at changes in the plan typical section.

Mat thickness will need to be checked regularly. It will have to be measured before rolling and after rolling to determine the decrease in thickness due to the compaction caused by rolling. It will also have to be checked regularly during paving to calculate yield or spread. Mat thickness can be determined before compaction by using a depth gauge, or by extending a straightedge over the edge of the mat and measuring the distance between the straightedge and base. After compaction, measuring with the straightedge is repeated. Also, cores of compacted mixtures may be cut out of the finished pavement for measurement and testing.

4.59.6 SEGREGATION

The development of open or segregated areas or spots in the placement of asphalt pavement layers should be recognized as significant cause for alarm and subsequent corrective action. This is particularly critical in the laying of the upper layer.

Segregated areas are prone to early failure as evidenced by the poor performance of these areas only a few years after placement. These are the areas that lead to the need for early correction such as seal coating and spot patching several years in advance of the expected or experienced life of the surface as a whole.

When it becomes evident that segregation is a problem, every effort should be extended to determine the cause of the problem and make correction. Table 3 provides general steps to avoid segregation:

Mix Design	Ensure that the aggregate gradation is well within tolerances and there are no gaps.
Stockpiles	Build horizontally. Limit layers to 6 feet. Avoid building cones by central conveyor.
Mixing Plant	Adjust mixing time to completely coat the aggregate. Use the specified percentage of asphalt. Keep aggregate bins full. Do NOT empty completely.
Storage	Equip the silo top with a gob hopper or a rotating chute. Fill the gob hopper complete before it is discharged. Drop the mix vertically into the gob hopper. Completely empty the gob hopper at each discharge.
Trucks	Use a weigh batcher to load into trucks. Load in three separate drops: front first, rear next and middle last.
Paver	Have truckers dump the full truckload to fill the hopper. Do NOT complete empty the hopper between each truckload. Do NOT dump the hopper wings when the hopper is empty. Keep the augers 2/3rds covered with mix. Run slat feeders 80-90% of the time. Operate the paver in a continuous manner. Do NOT stop between truckloads. Adjust the paver to run at the production speed of the plant.

Table 3: Steps to Avoid Segregation

4.59.7 CHECKING YIELD OR SPREAD

In estimating the quantity of asphaltic mixture required for a project, the value of 110 pounds per square yard per inch of thickness is normally used for the travel lanes, with an additional allowance up to 10% to provide for wedging, curve correction, and side road approaches. Since the contract quantity is an estimate only, the thickness of mat shown on the plan should be the governing objective rather than the contract quantity. Consequently, some under-run or over-run is to be expected.

In resurfacing work, the thickness of a course will be variable over its cross section due to variations in crown and surface irregularities in the base. In this case, unless otherwise required in the contract, the plan thickness should be considered the minimum dimension and any irregularities should be corrected by additional thickness of mat. In surfacing over new bases, the plan thickness should be closely approached, but minor variations can be tolerated.

The average thickness of the mat or layer being placed should be checked periodically on the basis of the total quantity of mixture placed over time (several hours, half day or day), compared with the theoretical. Any appropriate adjustments should be made. The amount of material that should theoretically be used for the

thickness of mat desired can be computed using the density in pounds per cubic foot being obtained on the job as determined from density samples taken from the pavement.

Example 1

Determine average actual thickness of a surface layer, compare against theoretical thickness and adjust as needed.

Density by test = 146.1 lbs/cubic foot

Plan depth = 3" (lower layer)

Width placed = 12'

Length placed = 3,250' in 4 hours (measured)

Tons placed = 650 tons (by ticket)

Weight/S.Y./Inch depth = $146.1 \times \frac{27}{36} = 109.58$ lbs.

Theoretical mass = $\frac{3{,}250' \times 12' \times 3'' \times 109.58}{9\ \text{S.F./S.Y} \times 2{,}000} = 712.27$ tons

Comparison with the 650 tons actually placed indicates less than plan thickness has been placed. The difference is over 8%. An adjustment is needed, by decreasing the distance paved per truckload as calculated below.

Example 2

Determine new required distance per truckload.

$146.1 \times \frac{1}{12}$ x 3" x 12' = 438.3 lbs./ft. is currently placed.

$438.3 \times \frac{712.27\ \text{Tons}}{650\ \text{Tons}} = 480.3$ lbs./ft. should be placed.

Length paved per truck should be = $\frac{\text{Net Weight of Load (lbs.)}}{480.3}$

Example using 30,000 lbs. load:

Length paved should be = $\frac{30{,}000}{480.3} = 63$ ft.

When the paver has been set to lay the proper depth of material to yield a compacted mat of the desired thickness, a reasonable correlation can be made between the loose depth behind the paver and the compacted thickness. Once this condition has been established, assuming proper foundation preparation and placement of leveling or wedging courses, adjustment of the paver thickness control should be held to a minimum. For instance, the inspector observes that a 1½" compacted plan thickness is achieved by placing a 1⅞" thickness with the paver. Thereafter, between regular calculations for yield the inspector will, for the same mixture, only have to check the loose depth occasionally to ensure that 1⅞" is being placed.

Example 3:

Say ¾ inch was allowed for consolidation, so 3¾ inches were being placed (un-compacted depth), but it has been shown to be insufficient from Example 1.

$(\frac{712.27}{650} \times 3) + .75$ inch = 4.04; say 4 inches

Increase un-compacted depth behind paver to 4 inches. Recheck per Example 1 above.